and JP 08-151461, in further view of U.S. Patent No. 4,592,968 to Taylor ("Taylor"). Claim 13 stands rejected under 35 U.S.C. § 102(b) as anticipated by Taylor. Finally, claims 4 and 9 have been allowed.

The Applicant has reviewed the September 11, 2002 Office Action, and respectfully submits the foregoing amendments and following remarks in response thereto.

The Applicant has amended claims 1, 10 and 13 to recite a feature of the present invention disclosed in the specification related to temperature during the heat press step. Support for these amendments may be found, for example, at specification page 18, line 5 through page 19, line 6. Claim 12 has been cancelled, without prejudice to the subject matter contained therein. Finally, new claims 14-17 have been added to further claim the present invention in product-by-process form. These new claims correspond to claims 1, 9, 10 and 13, respectively.

In view of these amendments and the following remarks, the Applicant respectfully requests reconsideration of the pending rejections and allowance of claims 1, 3, 5-8, 10 and 13-17, in addition to allowed claims 4 and 9.

1. <u>The Claims Are Patentable Over Sandelli and the Other Cited References</u>.

The Applicants respectfully traverse the rejection under §103(a) of claims 1, 3, 5-8 and 11-12 as unpatentable over Sandelli in view of JP 59042781 or JP 08-151461 and claim 10 as unpatentable over Sandelli, JP 08-151461 and Taylor, and the rejection of claim 13 as anticipated under §102(b) by Taylor, on the grounds that these references, either alone or in combination do not teach or suggest all the features of amended independent claims 1, 10 and 13 and their respective dependent claims.

As a threshold matter, the Applicant respectfully requests reconsideration of the § 103(a) rejections based on the assertion in the Office Action that "one of ordinary skill in the art would have the knowledge to choose to react the functional groups in about a 1:1 stoichiometry." While the Office Action attempts to fill in this missing element by way of this unsupported assertion, the very fact that the missing mixture limitations must be "assumed" in this manner demonstrates what the prior art shows -- that in the separator manufacture art, the present invention's mixture limitations have not been considered significant by those of ordinary skill. For example, JP 59-42781 neither discloses nor suggests any consideration of the ratio of epoxy group in the epoxy resin to the hydroxyl group in the phenolic resin, nor the ratio of epoxy

group in the phenolic resin. This reference contains no suggestion to one of ordinary skill to limit the groups ratios to the relatively narrow range of 0.8 to 1.2.

In view of the cited references' lack of teaching or suggestion to control group ratios in the narrow range of 0.8 to 1.2, reflecting the level of ordinary skill in the art as not recognizing the need to maintain the group ratio in the manner discovered by the Applicant in the present invention, the Applicant respectfully maintains that the cited references do not teach or suggest the present invention under § 103(a).

As a separate grounds for allowance, the Applicant notes the following. The present invention is directed to the use of an epoxy resin, and a phenolic resin as a binder, to form a separator while minimizing the generation of resin reaction byproducts and thus produce a superior separator. In the course of formation of such a separator with the present invention, the applicants have discovered that during the heat press step wherein carbon, the epoxy resin and the phenolic resin are combined, it is unnecessary to raise the temperature of the heat press to the point at which the epoxy resin and phenolic resin are carbonized. Thus, the binder in the instant invention serves to harden the resin without carbonization or excessive byproduct generation, and significantly enhances production rates by shortening the processing time required to form the separator. *See, e.g.*, Application at 18:5-19:6. Independent claims 1, 10 and 13 have been amended to specifically recite this aspect of the invention, reciting the step of "heat press forming the raw material charged into the mold at a temperature which is equal or less than a temperature at which the epoxy resin and the phenolic resin are carbonized." None of the cited references teaches or suggests this aspect of the present invention.

Taylor teaches the forming of separator plates by heating a carbonizable resin, coke and graphite particle mixture to 1,850°F (1,010°C) *in order to carbonize* the mixture. *See, e.g.*, Taylor at 8:19-24 and Abstract. Taylor thus teaches away from the present invention, which only heats the carbon and two resins as much as required to cause the mixture to begin to harden, without reaching a carbonizing temperature. Similarly, Sandelli also teaches deliberate carbonization of its materials by heating the materials to temperatures high enough to carbonize - in one embodiment, the same 1,850°F (1,010°C) level as taught by Taylor - and therefore also teaches away from the present invention. *See, e.g.*, Sandelli at 7:14-16.

As to the remaining two Japanese references, JP 08-151461 teaches *calcining* to obtain a *porous* product by subjecting its product to 1,000-3,000°C (1,832-5,432°F) -- a fundamentally

opposite approach to the present invention. *See* JP 08-151461 at [0031]. Of all the cited references, only JP 59042781 (English language Abstract) discusses heating a separator material to hundreds, rather than thousands, of degrees. However, this reference still teaches heating at temperatures notably higher than the present invention (250°C vs. 140-220°C), and makes no suggestion whatsoever of avoiding carbonization or otherwise maintaining lower temperatures to provide the present invention's improved separator production rates or separators with lower byproduct-related void fractions.

In view of the foregoing, the Applicant respectfully submits that no combination of Sandelli, JP 59042781, JP 08-151461 and Taylor teaches or suggests the invention recited in amended claims 1 and 10 and their respective dependent claims 2, 5-8 and 11-12, and therefore these claims are patentable over these references under §103(a). The Applicant further submits that for the above reasons, Taylor does not anticipate all the features of amended claim 13 under §102(b). Reconsideration and withdrawal of the pending §102(b) and §103(a) rejections is therefore respectfully requested.

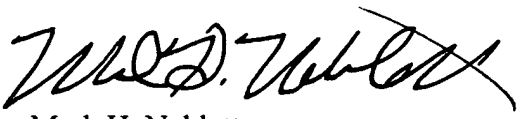
CONCLUSION

In view of the foregoing amendments and remarks, it is respectfully submitted that the presently pending claims are in allowable form. The Applicant earnestly solicits an early and favorable action on the merits and issuance of a Notice of Allowance for claims 1 and 3-13.

The Examiner is invited to contact the undersigned at (202) 220-4232 to discuss any matter concerning this application.

The Applicants do not believe that any additional fees are required in connection with this submission. Nonetheless, the Applicants authorize payment of any additional fees under 37 C.F.R. § 1.16 or § 1.17 or credit of any overpayment to Deposit Account No. 11-0600.

Respectfully submitted,



Dated: December 11, 2002

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MARKED-UP VERSION OF AMENDMENTS

IN THE CLAIMS:

1. (Fourth amendment) A method of manufacturing a separator for a fuel cell comprising:

preparing a raw material by mixing a carbon, an epoxy resin and a phenolic resin, wherein said phenolic resin is different from said epoxy resin, and further wherein a ratio of an amount of an epoxy group of said epoxy resin to an amount of a hydroxyl group of said phenolic resin in the raw material is adjusted to a value ranging from 0.8 to 1.2 such that generation of a reaction byproduct gas is minimized;

charging the raw material into a predetermined mold at a temperature which is equal or less than a temperature at which the epoxy resin and the phenolic resin are carbonized; and

heat press forming the raw material charged into the mold.

10. (Twice amended) A method of manufacturing a separator for a fuel cell comprising:

preparing a raw material by mixing a carbon, an epoxy resin and a phenolic resin, wherein said phenolic resin is different from said epoxy resin;

charging the raw material into a predetermined mold;

heat press forming the raw material charged into the mold at a temperature which is equal or less than a temperature at which the epoxy resin and the phenolic resin are carbonized; and

grinding a surface of the separator which is brought into contact with an adjacent member to be eliminated when the separator is incorporated into a fuel cell.

13. (Once amended) A method of manufacturing a separator for a fuel cell comprising:

preparing a raw material by mixing a carbon and a resin;

charging the raw material into a predetermined mold;

heat press forming the raw material charged into the mold at a temperature which is equal or less than a temperature at which the epoxy resin and the phenolic resin are carbonized; and

grinding a surface of the separator which is brought into contact with an adjacent member to be eliminated when the separator is incorporated into a fuel cell.